

WHAT IS CLAIMED IS:

- 1 1. A method for measuring a mechanical property of a vascular
2 wall which deforms in response to a transmural force under usual physiologic
3 pressures, the method comprising:
4 altering the transmural force to obtain an altered transmural force;
5 measuring local deformation of the vascular wall resulting from
6 physiologic pressures with the altered transmural force; and
7 determining a value for the mechanical property based on a measured
8 amount of local deformation.
- 1 2. The method as claimed in claim 1, wherein the mechanical
2 property is a non-linear elastic property of the vascular wall.
- 1 3. The method as claimed in claim 1, wherein the step of
2 measuring includes the step of non-invasively, ultrasonically imaging the vascular
3 wall.
- 1 4. The method as claimed in claim 1, wherein the step of altering
2 includes the step of reducing the transmural force to obtain a reduced transmural
3 force.
- 1 5. The method as claimed in claim 4, wherein the step of
2 reducing includes the step of applying an external pressure to the vascular wall.
- 1 6. The method as claimed in claim 5, wherein the external
2 pressure is substantially equal to a baseline internal pressure and wherein the
3 vascular wall deforms by pulse pressure during a cardiac cycle.
- 1 7. The method as claimed in claim 4, wherein the step of
2 reducing includes reducing an internal pressure to the vascular wall.

1 8. The method as claimed in claim 1, wherein the vascular wall
2 deforms a relatively small amount in response to a transmural force under usual
3 physiologic pressures and a relatively large amount in response to physiologic
4 pressures with the altered transmural force.

1 9. The method as claimed in claim 1, wherein the step of
2 determining includes the step of directly estimating strain of the vascular wall.

1 10. A method for measuring a mechanical property of a vascular
2 wall, the vascular wall being characterized by a relationship of arterial pressure
3 versus strain that exhibits a relatively large slope under physiologic pressure caused
4 by an arterial pressure pulse having a first mean arterial pressure and that exhibits
5 a relatively small slope under physiologic pressure caused by an arterial pressure
6 pulse having a second mean arterial pressure, the method comprising:
7 altering the first mean arterial pressure to obtain the second mean
8 arterial pressure;
9 measuring local deformation of the vascular wall at the second mean
10 arterial pressure; and
11 determining a value for the mechanical property based on the
12 measured amount of local deformation.

1 11. The method as claimed in claim 10, wherein the step of
2 measuring includes the step of non-invasively, ultrasonically imaging the vascular
3 wall.

1 12. The method as claimed in claim 10, wherein the step of
2 altering includes the step of reducing the first mean arterial pressure to obtain the
3 second mean arterial pressure.

1 13. The method as claimed in claim 12, wherein the step of
2 reducing includes the step of applying an external pressure to the vascular wall.

1 14. The method as claimed in claim 13, wherein the external
2 pressure is substantially equal to a baseline internal pressure and wherein the
3 vascular wall deforms by pulse pressure during a cardiac cycle.

1 15. The method as claimed in claim 12, wherein the step of
2 reducing includes reducing an internal pressure to the vascular wall.

1 16. The method as claimed in claim 10, wherein the step of
2 determining includes the step of directly estimating strain of the vascular wall.

1 17. A method for determining health of a vascular structure
2 including a vascular wall which deforms in response to a transmural force under
3 usual physiologic pressures, the method comprising:
4 altering the transmural force to obtain an altered transmural force;
5 measuring local deformation of the vascular wall resulting from
6 physiologic pressures with the altered transmural force; and
7 determining the health of the vascular structure based on the
8 measured amount of local deformation.

1 18. The method as claimed in claim 17, wherein the step of
2 measuring includes the step of ultrasonically imaging the vascular wall.

1 19. The method as claimed in claim 17, wherein the step of
2 altering includes the step of reducing the transmural force to obtain a reduced
3 transmural force.

1 20. The method as claimed in claim 19, wherein the step of
2 reducing includes the step of applying an external pressure to the vascular wall.

1 21. The method as claimed in claim 20, wherein the external
2 pressure is substantially equal to a baseline internal pressure and wherein the
3 vascular wall deforms by pulse pressure during a cardiac cycle.

1 22. The method as claimed in claim 19, wherein the step of
2 reducing includes reducing an internal pressure to the vascular wall.

1 23. The method as claimed in claim 17, wherein the vascular wall
2 deforms a relatively small amount in response to a transmural force under usual
3 physiologic pressures and a relatively large amount in response to physiologic
4 pressures with the altered transmural force.

1 24. The method as claimed in claim 17, wherein the step of
2 determining includes the step of directly estimating strain of the vascular wall.

1 25. A system for measuring a mechanical property of a vascular
2 wall which deforms in response to a transmural force under usual physiologic
3 pressures, the system comprising:

4 means for altering the transmural force to obtain an altered transmural
5 force;

6 means for measuring local deformation of the vascular wall resulting
7 from physiologic pressures with the altered transmural force; and

8 means for determining a value for the mechanical property based on
9 the measured amount of local deformation.

1 26. The system as claimed in claim 25, wherein the mechanical
2 property is a non-linear elastic property of the vascular wall.

1 27. The system as claimed in claim 25, wherein the means for
2 measuring includes means for non-invasively, ultrasonically imaging the vascular
3 wall.

1 28. The system as claimed in claim 25, wherein the means for
2 altering includes means for reducing the transmural force to obtain a reduced
3 transmural force.

1 29. The system as claimed in claim 28, wherein the means for
2 reducing includes means for applying an external pressure to the vascular wall.

1 30. The system as claimed in claim 29, wherein the external
2 pressure is substantially equal to a baseline internal pressure and wherein the
3 vascular wall deforms by pulse pressure during a cardiac cycle.

1 31. The system as claimed in claim 28, wherein the means for
2 reducing includes means for reducing an internal pressure to the vascular wall.

1 32. The system as claimed in claim 25, wherein the vascular wall
2 deforms a relatively small amount in response to a transmural force under usual
3 physiologic pressures and a relatively large amount in response to physiologic
4 pressures with the altered transmural force.

1 33. The system as claimed in claim 25, wherein the means for
2 determining includes means for directly estimating strain of the vascular wall.

1 34. A system for measuring a mechanical property of a vascular
2 wall, the vascular wall being characterized by a relationship of arterial pressure
3 versus strain that exhibits a relatively large slope under physiologic pressure caused
4 by an arterial pressure pulse having a first mean arterial pressure and that exhibits
5 a relatively small slope under physiologic pressure caused by an arterial pressure
6 pulse having a second mean arterial pressure, the system comprising:

7 means for altering the first mean arterial pressure to obtain the second
8 mean arterial pressure;

9 means for measuring local deformation of the vascular wall at the
10 second mean arterial pressure; and

11 means for determining a value for the mechanical property based on
12 the measured amount of local deformation.

1 35. The system as claimed in claim 34, wherein the means for
2 measuring includes means for non-invasively, ultrasonically imaging the vascular
3 wall.

1 36. The system as claimed in claim 34 wherein the means for
2 altering includes means for reducing the first mean arterial pressure to obtain the
3 second mean arterial pressure.

1 37. The system as claimed in claim 36, wherein the means for
2 reducing includes means for applying an external pressure to the vascular wall.

1 38. The system as claimed in claim 37, wherein the external
2 pressure is substantially equal to a baseline internal pressure and wherein the
3 vascular wall deforms by pulse pressure during a cardiac cycle.

1 39. The system as claimed in claim 36, wherein the means for
2 reducing includes the means for reducing an internal pressure to the vascular wall.

1 40. The system as claimed in claim 34; wherein the means for
2 determining includes means for directly estimating strain of the vascular wall.

1 41. A system for determining health of a vascular structure
2 including a vascular wall which deforms in response to a transmural force under
3 usual physiologic pressures, the system comprising:

4 means for altering the transmural force to obtain an altered transmural
5 force;

6 means for measuring local deformation of the vascular wall resulting
7 from physiologic pressures with the altered transmural force; and

8 means for determining the health of the vascular structure based on
9 the measured amount of local deformation.

1 42. The system as claimed in claim 41, wherein the means for
2 measuring includes means for non-invasively, ultrasonically imaging the vascular
3 wall.

1 43. The system as claimed in claim 41, wherein the means of
2 altering includes means for reducing the transmural force to obtain a reduced
3 transmural force.

1 44. The system as claimed in claim 43, wherein the means for
2 reducing includes means for applying an external pressure to the vascular wall.

1 45. The system as claimed in claim 44, wherein the external
2 pressure is substantially equal to a baseline internal pressure and wherein the
3 vascular wall deforms by pulse pressure during a cardiac cycle.

1 46. The system as claimed in claim 43, wherein the means for
2 reducing includes means for reducing an internal pressure to the vascular wall.

1 47. The system as claimed in claim 41, wherein the vascular wall
2 deforms a relatively small amount in response to a transmural force under usual
3 physiologic pressures and a relatively large amount in response to physiologic
4 pressures with the altered transmural force.

1 48. The system as claimed in claim 41, wherein the means for
2 determining includes means for directly estimating strain of the vascular wall.

1 49. The method as claimed in claim 1, wherein the local
2 deformation is an intramural deformation.

1 50. The method as claimed in claim 10, wherein the local
2 deformation is an intramural deformation.

1 51. The method as claimed in claim 17, wherein the local
2 deformation is an intramural deformation.

1 52. The system as claimed in claim 25, wherein the local
2 deformation is an intramural deformation.

1 53. The system as claimed in claim 34, wherein the local
2 deformation is an intramural deformation.

1 54. The system as claimed in claim 41, wherein the local
2 deformation is an intramural deformation.